Entergy Operations, Inc.
River Bend Station
5485 U S Highway 61
P O Box 220
St Francisville, LA 70775
Tel 225 336 6225
Fax 225 635 5068

Rick J. King
Director
Nuclear Safety Assurance

November 14, 2002

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Subject: River Bend Station
Docket No. 50-458
License No. NPF-47
Licensee Event Report 50-458 / 02-001-00

File Nos. G9.5, G9.25.1.3

RBG-46039
RBF1-02-0175

Ladies and Gentlemen:

In accordance with 10CFR50.73, enclosed is the subject Licensee Event Report. Commitments are identified on the included Commitment Identification Form.

Sincerely,

RJK/dhw
enclosure

IE22

cc: U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011

NRC Sr. Resident Inspector
P. O. Box 1050
St. Francisville, LA 70775

INPO Records Center
E-Mail

Mr. Jim Calloway
Public Utility Commission of Texas
1701 N. Congress Ave.
Austin, TX 78711-3326

Mr. Prosanta Chowdhury
Louisiana Department of Environmental Quality
Office of Environmental Quality
P. O. Box 82215
Baton Rouge, LA 70884-2215

Commitment Identification Form

COMMITMENT	ONE-TIME ACTION*	CONTINUING COMPLIANCE*
A review of other plant modifications undergoing phased implementation will be conducted to correct any similar conditions.	X	
Training on the lessons learned from this event will be conducted for the Operations staff.	X	

*Check one only

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE

Automatic Reactor Scram Due to Main Turbine Electro-hydraulic Control Malfunction

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER 05000
09	18	2002	2002	001	00	11	18	2002	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE	1
10. POWER LEVEL	100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

	20 2201(b)		20 2203(a)(3)(ii)		50 73(a)(2)(ii)(B)		50 73(a)(2)(ix)(A)
	20 2201(d)		20 2203(a)(4)		50.73(a)(2)(iii)		50 73(a)(2)(x)
	20 2203(a)(1)		50 36(c)(1)(i)(A)	X	50.73(a)(2)(iv)(A)		73 71(a)(4)
	20 2203(a)(2)(i)		50 36(c)(1)(ii)(A)		50.73(a)(2)(v)(A)		73 71(a)(5)
	20 2203(a)(2)(ii)		50 36(c)(2)		50 73(a)(2)(v)(B)		OTHER Specify in Abstract below or in NRC Form 366A
	20 2203(a)(2)(iii)		50 46(a)(3)(ii)		50 73(a)(2)(v)(C)		
	20 2203(a)(2)(iv)		50 73(a)(2)(i)(A)		50 73(a)(2)(v)(D)		
	20 2203(a)(2)(v)		50 73(a)(2)(i)(B)		50 73(a)(2)(vii)		
	20 2203(a)(2)(vi)		50.73(a)(2)(i)(C)		50 73(a)(2)(viii)(A)		
	20 2203(a)(3)(i)		50.73(a)(2)(ii)(A)		50 73(a)(2)(viii)(B)		

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Joseph W. Leavines, Manager – Licensing	225-381-4642

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED				15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO				

16. ABSTRACT (Limit to 1400 spaces, i e , approximately 15 single-spaced typewritten lines)

On September 18, 2002, at 8:25 p.m., an automatic reactor scram occurred while the plant was operating at 100 percent power. This event is being reported in accordance with 10CFR50.73(a)(2)(iv)(A) as an event that resulted in the automatic actuation of the reactor protection system and a manual actuation of the reactor core isolation cooling system.

The sequence of events leading to the scram began with a voltage transient in the main turbine electro-hydraulic control system. This resulted in a "close" signal to the main turbine control valves, which caused reactor steam pressure to rise. The scram was initiated by a high neutron flux signal in the average power range monitors resulting from the rise in reactor steam pressure. Following the scram, a valve in the main condensate pump discharge header closed unexpectedly, shutting off flow to the reactor feedwater pumps. All three reactor feedwater pumps tripped in sequence due to low suction pressure, as designed. Operators initiated the reactor core isolation cooling system to provide makeup water to the reactor.

This event is bounded by the analyses contained in the River Bend Updated Safety Analysis Report, and thus was of minimal significance with respect to the health and safety of the public.

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17. NARRATIVE *(If more space is required, use additional copies of NRC form 366A)*

REPORTED CONDITION

On September 18, 2002, at 8:25 p.m., an automatic reactor scram occurred while the plant was operating at 100 percent power. This event is being reported in accordance with 10CFR50.73(a)(2)(iv)(A) as an event that resulted in the automatic actuation of the reactor protection system and a manual actuation of the reactor core isolation cooling (RCIC) system.

The sequence of events leading to the scram began with a voltage transient in the main turbine electro-hydraulic control (EHC) system. This resulted in a "close" signal to the main turbine control valves (**TCV**), which caused reactor steam pressure to rise. The scram was initiated by a high neutron flux signal in the average power range monitors resulting from the rise in reactor steam pressure. Approximately three seconds elapsed from the EHC voltage transient to the scram actuation.

Following the scram, a valve in the main condensate pump discharge header unexpectedly closed, shutting off flow to the reactor feed pumps (**P**). All three reactor feed pumps tripped automatically due to low suction pressure, as designed. Operators initiated the RCIC system to provide makeup water to the reactor. Reactor pressure and water level were stabilized, and no reactor safety relief valves actuated. The Division 1 residual heat removal system was manually started in the suppression pool cooling mode to support RCIC operation. No other safety systems were actuated.

INVESTIGATION

Separate investigation teams were formed to determine the causes and action plans for the main turbine EHC malfunction and the loss of reactor feedwater pump suction pressure.

1) Main Turbine EHC Malfunction

The AC electrical power system for the EHC is supplied from two sources: house power and the permanent magnet generator (PMG). The primary source is the PMG when the turbine is at speed. The two AC sources feed independent power supplies (**JX**) which are interconnected on their outputs through a diode switching circuit internal to the power supplies. The DC electrical system is comprised of four separate buses: +22V, -22V, +24V, and +125V. The EHC first hit panel indicated that there was a low voltage condition on the +22V bus. Plant computer data records indicate this condition lasted for approximately 0.2 seconds.

The +22V house power and PMG power supplies were tested and found to be operating correctly. Interviews with personnel in the affected areas ruled out any potential interference by portable radios. The EHC system control board was inspected, and all its outputs were verified. Detailed inspections of termination boxes at the turbine control valves, intercept valves, and stop valves found no wiring defects. Wiring inspections in the turbine front standard and the EHC cabinet were satisfactory.

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2) Loss of Reactor Feedwater Pump Suction Pressure

The valve (**FCV*) that closed in the main condensate pump discharge header, CNM-FCV200, is an air-operated butterfly valve that was installed in May 2002 during a planned outage. The valve will function to bypass the full-flow condensate filtration system that is currently being installed. In the as-left condition following its installation, the valve handwheel was locked in position after being used to open the valve, and the lever that engages the handwheel to the valve operating mechanism was left in the "disengaged" position. The air supply to the power actuator was not connected, as remote operation of the valve is not required until the installation of the filtration system is complete.

With the handwheel disengaged, the valve disc was not positively locked in the open position. The disc was dislodged by the system flow transient following the scram, and moved to the closed position, dead-heading the condensate pumps. Condensate discharge header pressure increased rapidly, causing the failure of gaskets in the flanged piping connections (**PSF**) to the steam jet air ejector intercondensers. The main condensate pumps were subsequently shut down to allow replacement of the gaskets. The RCIC system operated normally to maintain reactor water level throughout the repair and system restoration.

3) Other plant responses

Within an hour following the scram, pipe flow noises were heard in the vicinity of the condensate storage tank (CST), and a small amount of vapor was seen coming from the atmospheric vent on top of the tank (**TK**). Evaluations were performed to determine whether the piping and tank were being adversely affected, or whether a release of radioactivity had occurred.

The CST is the normal suction source for the RCIC system, which was operating at the time. When the RCIC system is maintaining reactor water level, system control valves are positioned as required to direct the pump discharge flow to either the reactor or to the CST. This return flow to the CST accounts for one source of the noises heard at the tank.

Also, the CST receives flow from the minimum flow line from the control rod drive hydraulic (CRD) pump discharge. The normal suction source for the CRD pumps is the main condensate system. As a result of the transient in the condensate system described above, the suction temperature of the CRD pump increased from approximately 140F to near 347F. As the minimum flow line discharged through its orifice into the CST air space, the water was flashing to steam during the time it was above 212F. This was also a source of the noise at the tank.

Subsequent evaluation determined that neither the CST nor the CRD pump was adversely affected by the elevated temperature. Also, the bulk temperature of the CST was not increased sufficiently to reduce the net positive suction head margin for the RCIC pump. The high pressure core spray (HPCS) pump also uses the CST as its normal suction source, but that pump was not operated during this event. As in the case of the RCIC pump, the net positive suction head margin for the HPCS pump was not adversely affected by the elevated temperature in the CST. The CST is not the safety-related suction source for RCIC or HPCS. That function is provided by the suppression pool under accident conditions. The CST is not credited for accident mitigation in the plant safety analysis.

17. NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)*

The CST is normally vented to atmosphere through a stack on the tank top. In normal plant operation, small amounts of dissolved noble gases are assumed to be introduced into the CST from multiple sources. These gases come out of solution and subsequently exit the tank vent.

On the morning following the scram, air samples were taken at the tank, and contamination surveys were made on the tank top. No airborne particulate activity or iodine was detected, and no surface contamination was found. Noble gas concentrations were consistent with concentrations found in the CST. Dose calculations concluded that the radioactivity from the CST vent during this event was less than allowed by 10CFR20, 10CFR50 and associated Technical Requirements limits.

CAUSE ANALYSIS AND IMMEDIATE ACTIONS

1) Main Turbine EHC Malfunction

The EHC first hit panel indicated that there was a low voltage condition on the +22V bus. Extensive testing did not conclusively identify a cause for the voltage transient. The +22V bus includes a section of bare copper conductors running below the panel floor. Discussions with the vendor indicate that grounds in other units have occurred in this bus section with similar results. Inspections performed during the forced outage were not able to rule out the possibility of an intermittent or short duration ground in this area. Elimination of other potential failure modes led investigators to conclude that the most likely cause was a momentary ground condition on the +22V bus.

The house power and PMG +22V power supplies have been replaced. High speed recording instrumentation has been installed on the turbine EHC system to obtain additional data should the suspected ground condition recur.

2) Loss of Reactor Feedwater Pump Suction Pressure

The as-left position of the CNM-FCV200 handwheel disengagement lever prior to the scram was not appropriate for the system configuration, and resulted from ineffective communications between plant departments during installation of the valve and subsequent startup of the condensate system. A detailed Events and Causal Factor analysis was performed by the investigation team which identified numerous broken barriers that could have prevented this aspect of the event. These inappropriate actions can be summarized as follows:

- Engineering and Operations personnel recognized at multiple points during the project that the valve had an unusual design, but inadequate action was taken to assure that the needed information was obtained and distributed.
- The need to positively lock the valve disc in position for system startup was emphasized during management review and approval of the phased implementation of the modification. However, sufficient accountability was not enforced to assure success in locking the valve.

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Following manual positioning of a power-operated valve, it is standard practice to prepare the valve for remote operation by disengaging the manual operator. That action was inappropriate for this valve in its unique configuration. Operating instructions developed during the modification installation process were not adequate to guide the operators in positioning the valve, resulting in the handwheel being left disengaged.

Condensate valve CNM-FCV200 has been opened and locked in position with the handwheel engaged.

CORRECTIVE ACTION TO PREVENT RECURRENCE

The following actions are planned in response to this event:

1) A plant modification is being considered to upgrade the turbine EHC system to improve reliability.

2) Further inspections of normally inaccessible sections of EHC system wiring and bus bars are being planned.

3) A review of other plant modifications undergoing phased implementation will be conducted to correct any similar conditions.

4) Training on the lessons learned from this event will be conducted for the Operations staff. This training has been completed for the Engineering staff.

PREVIOUS OCCURRENCE EVALUATION

A main turbine trip occurred in June 1996 when the house power +22V power supply voltage output failed low. (See LER 50-458 / 96-012-00.) That power supply was replaced, and the new power supply had been in service since that time. Investigation of the September 2002 event found the house power supply to be functioning properly, and not a likely contributor to the voltage transient. Thus, this event is not considered a recurrence of the June 1996 event.

SAFETY SIGNIFICANCE

This event is bounded by the transient analysis contained in the River Bend Updated Safety Analysis Report, and thus was of minimal significance with respect to the health and safety of the public.

Note: Energy Industry Identification Codes are indicated in the text as (**XX**).